1.0 INTRODUCTION

1.1 Proposed Project and Proponent

The Canadian Nuclear Safety Commission (CNSC) defines decommissioning as "those actions taken, in the interest of health, safety and the protection of the environment, to retire a licensed activity/facility permanently from service and render it to a predetermined end-state condition" (CNSC, 2000a).

Ontario Power Generation Inc. (OPG) proposes to decommission the Bruce Heavy Water Plant (BHWP) facility on the Bruce nuclear site. The BHWP is no longer in operation. It produced heavy water for use as a moderator in OPG's and other CANDU reactors.

OPG is a successor company to Ontario Hydro which originally constructed and operated the BHWP. As the owner and operator of the facility, OPG is the proponent for the decommissioning project.

1.1.1 Purpose of the Project

The purpose of the project is to permanently retire the BHWP from service as a nuclear facility licensed for the production of heavy water. All of the buildings, structures and equipment required for the operation of the licensed nuclear facility are to be removed or demolished so that upon completion of this decommissioning, the site can be used by OPG for industrial purposes unrelated to the production of heavy water or continue to be used to store OPG's inventory of heavy water under the authority of a licence from the CNSC.

1.1.2 Project Need and Rationale

1.1.2.1 History of Operation

The history of the facility is included to explain how the facility arrived at its current state. Past activities at the BHWP are not part of the BHWP Decommissioning Project.

The BHWP was in continuous operation from April 1973 until March 1998, producing over 16,000 megagrams (Mg) of reactor grade heavy water. Originally, Ontario Hydro planned to build a total of four heavy water plants at the Bruce nuclear site (Plants A to D), each consisting of two enriching units, one finishing unit, and associated auxiliary systems and buildings required to support heavy water production. These plants were designed to produce 800 Mg/annum. The development or operating history of the four heavy water plants is briefly described below.

Plant A

Plant A consisted of Enriching Units Nos. 1 and 2 (E1 and E2), Finishing Unit No. 1 (F1), and associated auxiliary systems. It produced its first reactor grade heavy water in April 1973.

Plant A continued to operate until 1984 when it was shut down. All of the hydrogen sulphide (H_2S) was removed from both E1 and E2 and transferred to the H_2S storage area. The plant was placed in a safe mothballed state, and remained as such until approval to demolish most of the above-ground structures for safety and economic reasons was received from the Atomic Energy Control Board (AECB), predecessor to the CNSC. The following buildings were demolished during 1993-94:

- E1 (excluding its substation);
- E2 (excluding its substation);
- F1;
- South Flare Area;
- Plant A Substation;
- South Clarifier;
- Plant A Degassers;
- Plant A Acid & Caustic Storage Area.

The Utilities Building (excluding its substation) was demolished in 1995.

Plant B:

Plant B consisted of E3 and E4, F2, and associated auxiliary systems. Plant B was completed and placed in service in 1979.

By the end of 1993, Plant B had produced enough heavy water to meet Ontario Hydro's needs. At that time, a decision was made to shut down and demolish one of the enriching units (E3) in Plant B, thereby reducing the plant's capacity by 50%. E4 continued to operate to produce heavy water for external markets.

In 1994, Ontario Hydro received permission from AECB to demolish and remove the above-ground portions of E3. The unit (excluding its Antifoam Building) was successfully demolished during 1995. E4 was shut down on May 1, 1997 due to a problem with the steam supply from Bruce A. On May 24, 1997, this outage was extended into a planned maintenance outage. On August 30, 1997, a decision was made to permanently shut down the BHWP and the E4 outage became permanent. Subsequently, all of the H_2S was removed from E4 and was returned to the storage area.

Approval to dispose of the H_2S by controlled flaring was received from both the AECB and the MOE in early November of 1997. Controlled flaring commenced on November 6, 1997 and was completed on January 23, 1998. A total of 619.9 Mg of H_2S was flared during this period. Upon completion of flaring, only 1 Mg of H_2S remained in the plant. Removal of the H_2S from the remaining systems was completed by March 31, 1998. Integrity checks were carried out to ensure that the systems were totally free of all H_2S.

After the final shutdown, all other chemicals associated with the production of heavy water were disposed of using approved conventional methods. In addition, systems required for continued operation have been physically isolated from the shut down portion of the plant. To ensure

continued operation of these systems, it was necessary to reconfigure some of the piping and electrical systems.

Plants C and D

Plants C and D were intended to consist of Enriching Units (E5 and E6 for Plant C, and E7 and E8 for Plant D), Finishing Units, and associated auxiliary systems. Plant C was cancelled in the early stages of construction. No above-ground structures were built nor were any underground services installed.

Construction of Plant D was suspended in 1978 after approximately 70% of the facility was completed. The structures that had been completed were mothballed and no part of Plant D was ever exposed to H_2S or other chemicals used in the production of heavy water. Ontario Hydro requested AECB approval to proceed with demolition and removal of the above-ground portions of E8 on December 21, 1994. The AECB responded on January 30, 1995 indicating that Ontario Hydro did not require AECB approval to demolish E8. The unit (excluding its Antifoam Building and substation) was demolished in 1995.

1.1.2.2 Rationale for Decommissioning Project

In August 1997 Ontario Hydro made a decision to stop the production of heavy water at the BHWP because it had determined that it had sufficient heavy water inventories to meet its own needs and its contractual commitments to AECL. A series of actions had been taken, involving the mothballing of some facilities and the demolition of others, notably the enriching towers E3 and E8. At present there are no active production facilities on the site. OPG proposes to complete the work started by Ontario Hydro during 1993-1995 and permanently retire and remove the remaining heavy water production facility that is surplus to OPG's business needs. There are several reasons why it wishes to proceed with the decommissioning.

- OPG intends to restore the site to a state suitable for industrial uses and would like to be able to respond to any requests to use the site for such purposes;
- While the facility has been safely mothballed, some facilities, particularly the enriching towers, are not being maintained and, as they age, are showing signs of deterioration. OPG would like to demolish the towers before deterioration of the structures increases the hazards of decommissioning;
- OPG would like to reduce maintenance and operating costs at the BHWP and would like to avoid any increase in costs that may emerge from decommissioning a more hazardous structure at a later date; and
- OPG would like to complete the environmental remediation of the site, in particular the contaminated (not radioactive) soils, and restore views of the site to a more natural pre-enrichment tower condition.

1.1.3 Location of the Project

The BHWP is located entirely on the Bruce nuclear site. The Bruce nuclear site (formerly known as the Bruce Nuclear Power Development or BNPD) occupies 932 ha (2300 acres) on the

east shore of Lake Huron, about midway between the towns of Kincardine and Port Elgin (Figure 1.1). The Bruce nuclear site is located approximately 250 km north-west (geographic direction) of Toronto, Ontario at a longitude of 81°30' west and latitude 44°20' north. It may be reached from Provincial Highway No. 21 by one of two concession roads (No. 2 and No. 4).

The BHWP is situated in an irregularly shaped, fenced area on the western (lake) side of the Bruce nuclear site. It is located north and east of the Douglas Point Waste Management Facility (Figure 1.2). The BHWP site has maximum measurements of approximately 960 m by 750 m. Plant A was centrally located on the southern half of the BHWP site. The remainder of Plant B is located immediately east of the former Plant A, and the incomplete Plant D is located north of Plant B.

There are 914 m exclusion zones around the Bruce A and Bruce B stations. These zones restrict the types of uses that can occur within them. Several structures which are part of the BHWP are wholly or partly in the Bruce B exclusion zone.

1.1.4 Project Schedule

It is anticipated that decommissioning work on the BHWP, subject to environmental assessment (EA) and licence approvals, will begin in 2003. The demolition/remediation activities are expected to take seven to eight years to complete. Environmental monitoring will continue for up to three years after the end of the demolition/remediation work.

1.2 Regulatory Requirements

1.2.1 Canadian Environmental Assessment Act

The decommissioning project cannot proceed without the prior licensing approval of the CNSC pursuant to the *Nuclear Safety and Control Act* (*NSCA*). Licensing approval from the CNSC invokes a federal environmental assessment pursuant to Section 5 (1)(d) of the *Canadian Environmental Assessment Act* (the *Act*). This project is not of a type that is listed in the *Exclusion List Regulations* of the *Act*. As the licensing body, the CNSC is the Responsible Authority (RA) under the *Act* for the purpose of this assessment.

1.2.1.1 Comprehensive Study List Regulations

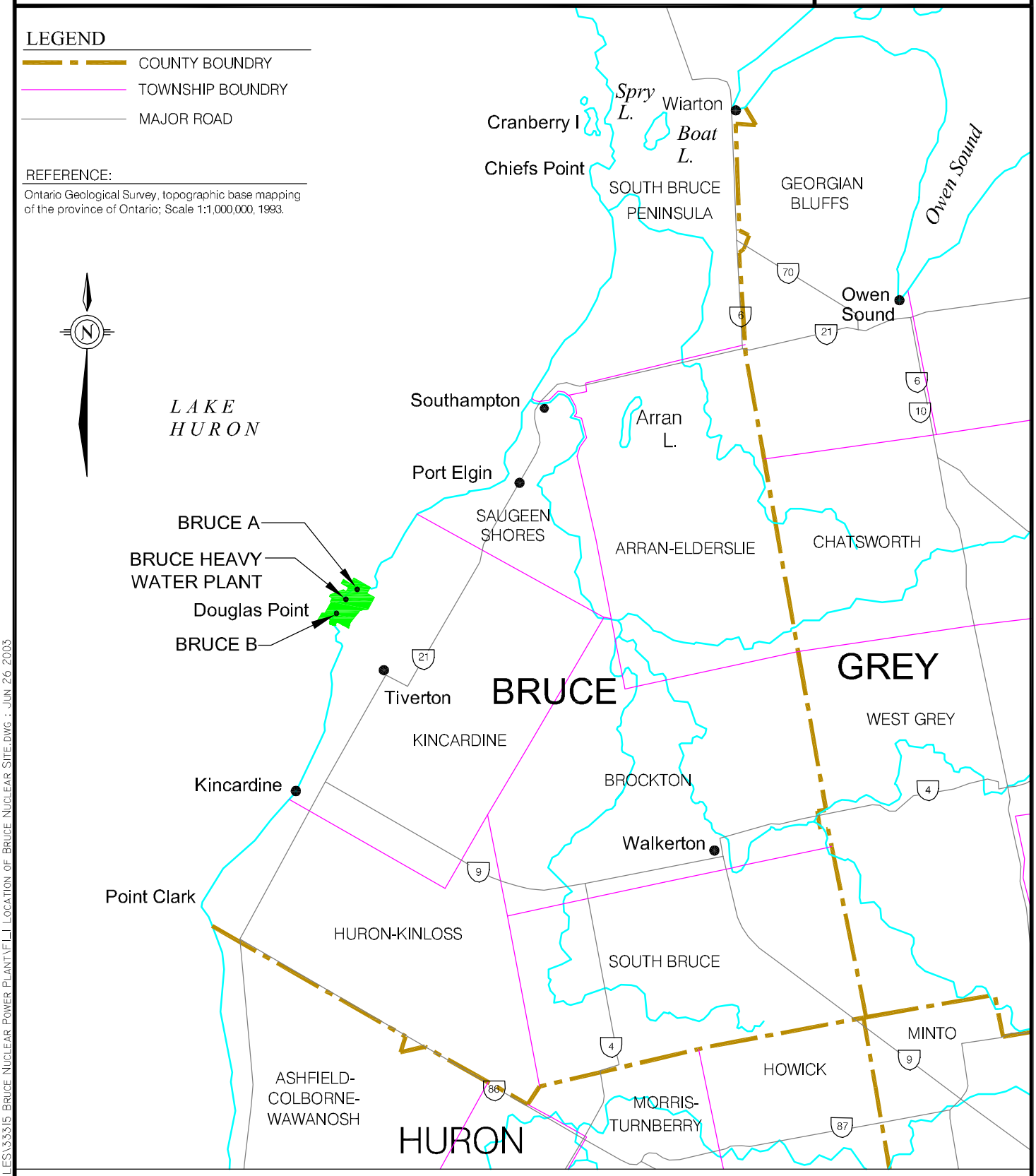
In accordance with the *Act*, only those projects which are listed in the *Comprehensive Study List Regulations* pursuant to the *Act* require a Comprehensive Study assessment. Part VI of these *Regulations* identifies those nuclear and related facility projects that require a Comprehensive Study and includes the proposed decommissioning or abandonment of a heavy water production facility. Therefore, a Comprehensive Study is required for the BHWP project.

1.2.1.2 Federal Roles and Responsibilities

The CNSC is currently the only RA under the *Act* that has been identified for this environmental assessment (EA). As the RA, the CNSC is required to ensure that a Comprehensive Study be

LOCATION OF BRUCE NUCLEAR SITE

FIGURE 1.1



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ONTARIO POWER GENERATION

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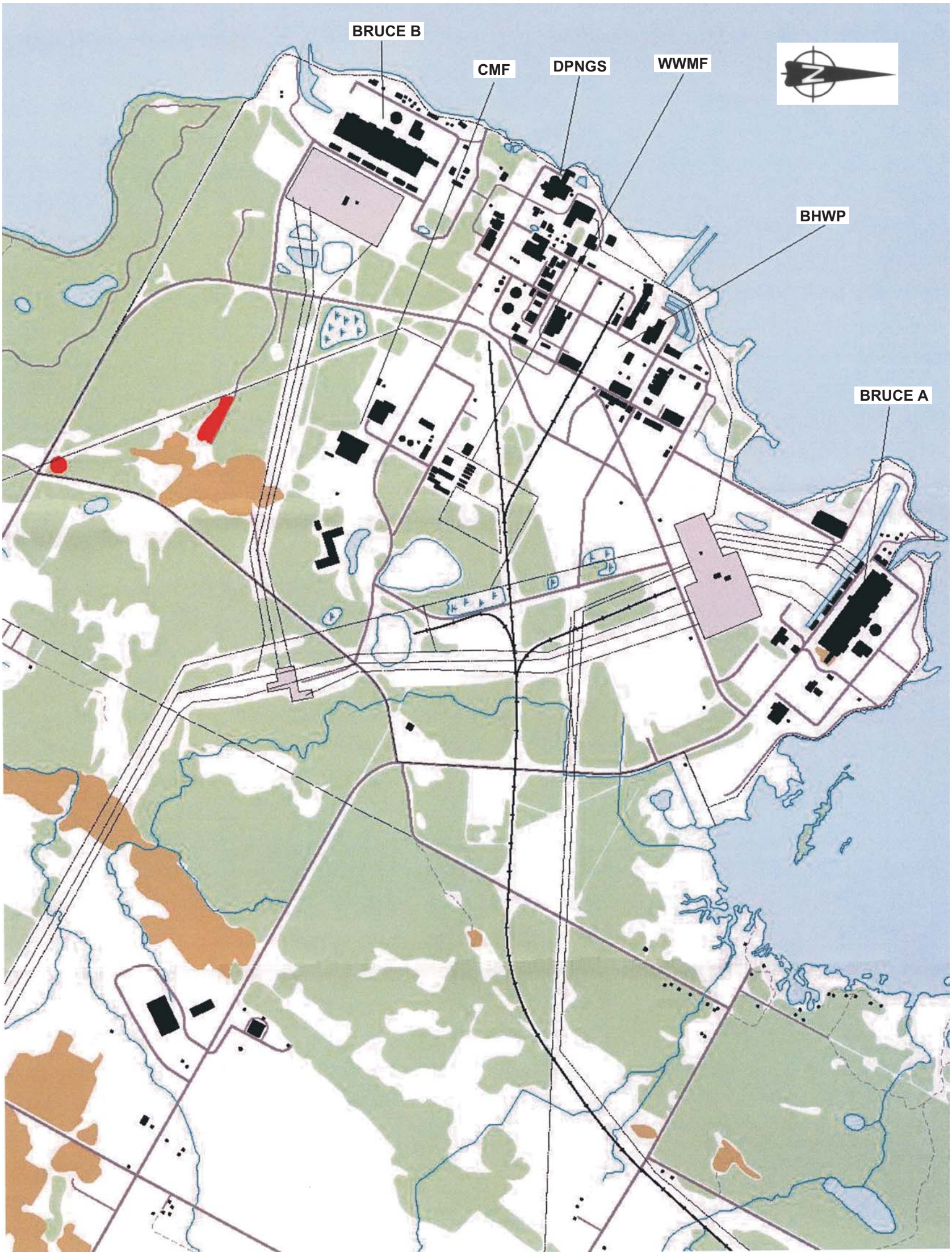
LOCATION OF BRUCE HEAVY WATER PLANT ON BRUCE NUCLEAR SITE

FIGURE 1.2



LEGEND:

BHWP	Bruce Heavy Water Plant (Shut down)
BRUCE A	Bruce Nuclear Generating Station A
BRUCE B	Bruce Nuclear Generating Station B
DPNGS	Douglas Point Nuclear Generating Station (Shut down)
WWMF	Western Waste Management Facility
CMF	Central Maintenance Facility

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FIG1.2 11x17.CDR

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conducted. A Comprehensive Study Report (CSR) is to be prepared and submitted to the federal Minister of Environment and the Canadian Environmental Assessment Agency (Agency), pursuant to section 21 of the *Act,* before the proposed licensing decision can be made pursuant to the *NSCA*.

Pursuant to the *Federal Coordination Regulations* under the *Act*, Environment Canada and Health Canada declared themselves as expert Federal Authorities with interests in the decommissioning project. Fisheries and Oceans Canada initially indicated an interest in participating as an expert Federal Authority, but subsequently withdrew when it determined that there were no environmental assessment issues associated with the project involving fish or fish habitat.

CNSC, pursuant to subsection 17(1) of the *Act*, has delegated to OPG the conduct of the technical support studies for the EA and the public consultation program as well as the preparation of the EA Study Report. CNSC and the expert Federal Authorities will review the EA Study Report. Once accepted, it will be used by the CNSC as the basis for the preparation of the Comprehensive Study Report under the *Act* for this project.

1.2.1.3 Public Registry

CNSC has established a public registry for the EA as required by section 55 of the *Act*. This includes identification of the EA in the Federal Environmental Assessment Index, which can be accessed on the website of the Canadian Environmental Assessment Agency (www.ceaa.gc.ca). The Federal Environmental Assessment Index reference number for this project is 16968.

1.2.1.4 Stakeholder Consultation

OPG undertook a number of community and stakeholder communications and consultation activities. These activities were undertaken with the following objectives:

- To update key stakeholders on plans to decommission the BHWP;
- To provide the Bruce Community with opportunities to learn about the BHWP decommissioning project;
- To ensure public comments are documented and addressed in the EA Study Report; and
- To maintain and build upon existing key stakeholder and local community support for on-going operations on the Bruce nuclear site.

1.2.2 Canadian Nuclear Safety Commission Licences

1.2.2.1 Nuclear Facility Licences

The BHWP is regulated by the CNSC under a Heavy Water Plant Operating Licence issued pursuant to the *NSCA*. A portion of the facility, for which construction was started but never

completed, is governed under a Construction Approval issued by the AECB in 1980. The licence and approval provide for the continued maintenance of the facilities in their current shut-down state. Figure 1.3 shows the areas of the BHWP that are currently regulated by CNSC.

The current Heavy Water Plant Operating Licence HWPOL 405-12.3 was issued on June 1, 2001 and expires on October 31, 2002. The total area of the BHWP currently governed under this licence is approximately 30 hectares and includes:

- Plant B excluding E3;
- Common Services Area including the H_2S storage area;
- Drum Filling Building (Building 506, located in the area of the former Plant A); and
- Heavy Water Storage Area in Operations Building D.

Other areas of the BHWP that were previously governed under the Heavy Water Plant Operating Licence included Plant A and E3 of Plant B. The Plant D Construction Approval Amendment No. 1 was issued on February 1, 1980 and does not have an expiry date. The physical area of the BHWP governed under this licence includes the areas occupied by E7 and E8, which were never completed.

The southern third of the BHWP, including the former Plant A (now mostly demolished) lies within the exclusion zone of Bruce B. Some of those buildings, structures and pipe racks will be demolished during the course of the BHWP Decommissioning Project.

An application for a Licence to Decommission as described in Section 7 of the *Class I Nuclear Facilities Regulations* (CNSC, 2000b) has been submitted to the CNSC by OPG. This application requested permission to proceed with the decommissioning of the BHWP. The application was supported by a Detailed Decommissioning Plan (DDP) (OPG, 2002) prepared in accordance with the guidelines set out in CNSC Regulatory Guide G-219 (CNSC, 2000a) and submitted by OPG in May 2002. Upon completion of the decommissioning work, OPG will prepare a Final Decommissioning Report that will describe the decommissioning work that was performed and the results of that work. After the decommissioning is complete, OPG will apply to the CNSC for approval to abandon the BHWP site as described in Section 8 of the *Class I Nuclear Facilities Regulations*.

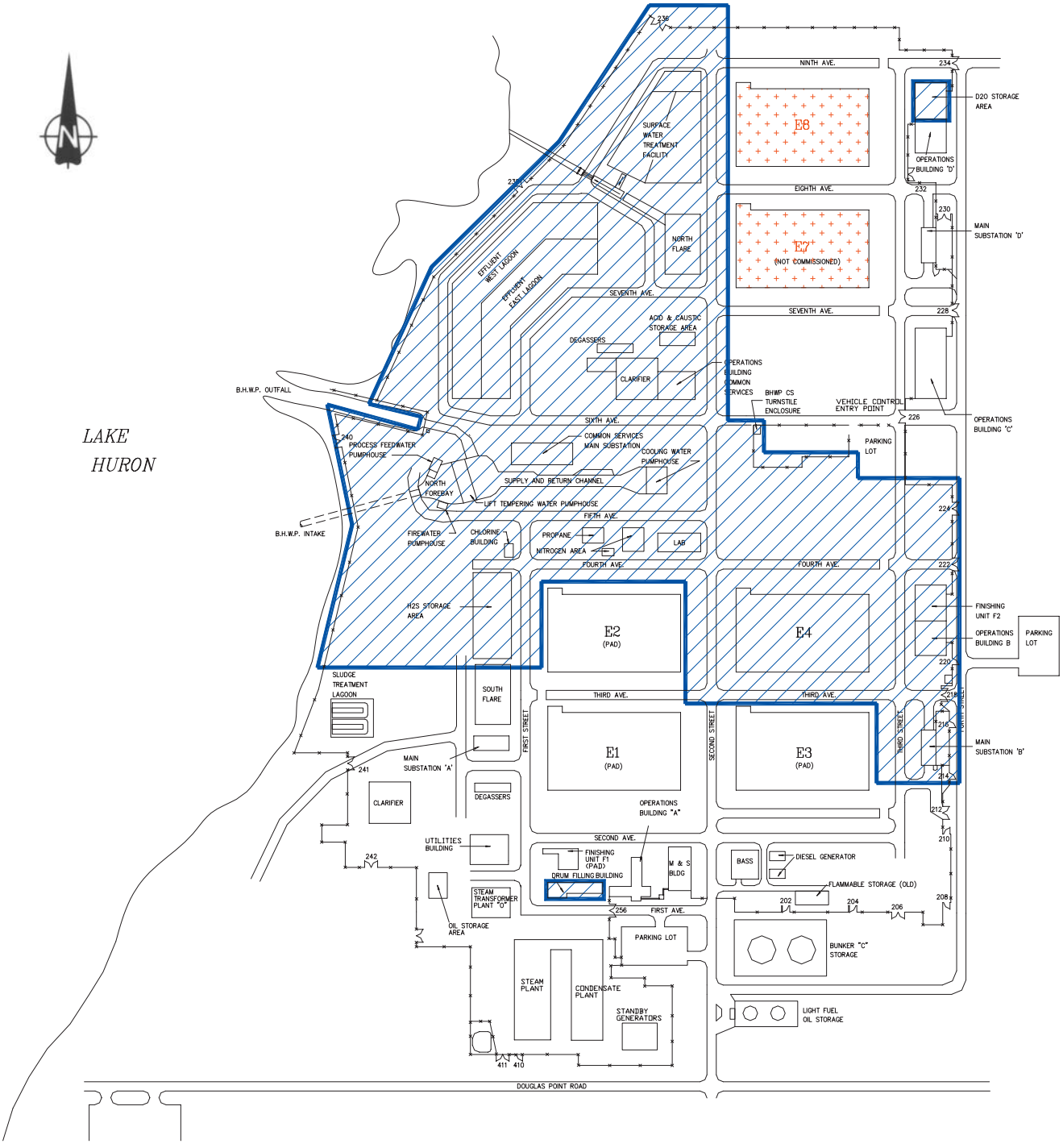
1.2.2.2 Nuclear Substance Licence

OPG currently stores non-radioactive heavy water in bulk tanks located in the Heavy Water Storage Areas of F2 and F4, attached to Operations Buildings B & D (buildings 528 and 578). OPG intends to continue this practice throughout the course of the BHWP Decommissioning Project and following the completion of the project. Heavy water will not be stored in the Drum Filling Building (building 506) during the course of the Decommissioning Project; however, OPG intends to store heavy water in this building following completion of the decommissioning project.

Neither F2 nor F4 will be demolished, renovated or modified during the course of the decommissioning and both buildings will remain outside of the designated Construction Islands

AREAS OF THE BRUCE HEAVY WATER PLANT CURRENTLY REGULATED BY CNSC

FIGURE 1.3



LEGEND:

DENOTES BHWP BOUNDARY FENCE

DENOTES AREA COVERED UNDER CURRENT CNSC OPERATING LICENCE

DENOTES AREA COVERED UNDER 1980 PLANT 'D' CONSTRUCTION APPROVAL

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Fig 1.3 8.5x11 CDR

that will be placed under the control of the General Decommissioning Contractor (GDC). OPG staff will continue to operate the Heavy Water Storage Areas according to existing procedures throughout the project.

OPG will submit an application for a nuclear substance licence to permit the continued storage of its inventory of heavy water in the Heavy Water Storage Areas of F2 and F4 and the Drum Filling Building following the completion of the BHWP Decommissioning Project. The application for this licence will be submitted prior to, or in conjunction with, the application for a Licence to Abandon the BHWP site. Therefore, those buildings remaining would no longer be part of a Heavy Water Plant and would not be subject at a later date to undergoing a Comprehensive Study under the *Act*.

The possession and use of uranium metal foil in the infrared absorption analyzers in the Common Services Laboratory is already permitted under the terms of a Consolidated Radioisotope Licence applicable to this laboratory. No revision of this licence will be required as the result of the decommissioning.

1.2.3 Environmental Permits and Registrations

Although Ontario Hydro (predecessor to OPG) submitted a provincial EA in the mid-1970s in support of its proposal at that time to expand the BHWP (Plants B, C, and D), there are no provincial environmental assessment requirements applicable to this decommissioning project under the Ontario *Environmental Assessment Act*. However, the Ontario Ministry of the Environment (MOE) has issued guidelines for the cleanup of contaminated sites (MOE, 1997) that are applicable to the decommissioning work that will be performed at BHWP.

The Owen Sound District Office of the MOE was officially informed of this project in 1998. There is a Certificate of Approval (C of A) for the Surface Water Treatment Facility (SWTF). Discharge of water from the SWTF is the only regulated stream associated with this project.

OPG is registered with the MOE as a generator of hazardous wastes. OPG's Waste Generator Registration Number is ON0018401 (revised January 19, 2000). OPG will prepare and file an Annual Generator Registration Report with the MOE if one is required.

The MISA (Municipal Industrial Strategy for Abatement) Regulations for the Electrical Power Generation Sector apply to the BHWP. Four buildings that formerly housed equipment used to monitor compliance with MISA requirements will be demolished during the course of the decommissioning project. This equipment was used to monitor sampling points that have been eliminated in accordance with Section 7(3) of the MISA Regulations for the Electrical Power Generation Sector.

The GDC will file notice of the BHWP Decommissioning Project with the Ontario Ministry of Labour as required by Section 5(1) of the *Regulations for Construction Projects* made pursuant to the *Occupational Health & Safety Act*. The GDC will be the 'Constructor' on the BHWP Decommissioning Project and will fulfill all of the duties of the Constructor set out in the *Occupational Health & Safety Act* and the *Regulations for Construction Projects*.

1.2.4 Building Permits

One or more building permits will be required for the work to be performed during the BHWP Decommissioning Project. The GDC will acquire the necessary permits.

1.3 Scope of Project and Assessment

In 1997, Ontario Hydro's Board of Directors announced that it would permanently shut down and decommission the BHWP. Decommissioning requires approval from the AECB (now the CNSC) which in turn triggered the need for a Comprehensive Study pursuant to the *Act*. In September 1998, OPG, as the proponent of the project, announced that it was beginning the preparation of an EA.

1.3.1 Scope of the Project

A map of the BHWP showing the limits of the BHWP Decommissioning Project and the locations of the major structures scheduled for demolition is presented in Figure 4.2.

The scope of the BHWP Decommissioning Project includes the following activities:

- demolition of the above-grade components of the BHWP within the area regulated by the CNSC as described in Section 1.2.2.1, except for those components and infrastructure required to maintain site service system integrity for other separately licensed facilities on the Bruce nuclear site;
- segregation, preparation and transport off site to appropriate locations of any reusable and recyclable materials and equipment;
- disposal of some waste at the Bruce nuclear site landfill;
- segregation and transport off site of all remaining hazardous and non-hazardous waste to authorized waste management facilities; and
- remediation of the facility to a condition suitable for general industrial land uses.

Not included in the scope of the project is the removal of several buildings and facilities on the site that will be retained for office and laboratory uses, pumping of water, electrical distribution and the storage of residual heavy water inventory.

Further details on the scope of the project are provided in Chapter 3 of this report.

1.3.2 Scope of Assessment

The scope of the assessment under the *Act* must include all factors identified in paragraphs 16(1)(a) to (d) of the *Act*, and, as provided under paragraph 16(1)(e), any other matter that CNSC requires to be considered. The following factors are required:

- The environmental effects of the project, including the effects of malfunctions or accidents, that may occur in connection with the project and any cumulative environmental effects that

are likely to result from the project in combination with other projects or activities that have been carried out;

- The significance of the effects identified above;
- Comments from the public that are received in accordance with the *Act* and its regulations; and
- Measures that are technically and economically feasible that would mitigate any significant adverse environmental effects of the project.

In accordance with subsection 16(2) of the *Act*, a Comprehensive Study requires that the following additional factors be considered in the environmental assessment:

- The purpose of the project;
- Alternative means of carrying out the project that are technically and economically feasible and the environmental effects of any such alternative means;
- The need for, and requirements of, a follow-up program in respect of the project; and
- The capacity of renewable resources that are likely to be significantly affected by the project to meet the needs of the present and those of the future.

Further, and to enable adequate consideration of the above factors, the scope of assessment also includes a description of the project and a description of the existing environment that may be affected by the project activities.

The assessment deals only with decommissioning activities up to the "end state" of the project. The "end state" is defined as the state of the BHWP site after all decommissioning activities are completed and the requirements for regulatory approvals are met. The end state objectives are delineated in the DDP (OPG, 2002) and in Section 3.6 of this report.

1.3.3 Summary of Environmental Assessment Background

As indicated previously, OPG announced in September 1998 that it was beginning to prepare an EA to support regulatory approval of the BHWP Decommissioning Project.

In November of 1998, OPG initiated a program of consultation activities in the community in support of the EA. However, progress of the EA and related consultation was interrupted by OPG decontrol activities required by provincial legislation, as explained in Section 5.3. In June of 2001 OPG completed and submitted a preliminary draft EA Study Report to the CNSC (OPG, 2001).

In March of 2002, the CNSC, as the Responsible Authority, completed the preparation of a draft Comprehensive Study Report for the BHWP Decommissioning Project to which the OPG

preliminary draft EA Study Report was attached as a supporting document. This was submitted to the Canadian Environmental Assessment Agency and other federal agencies for review. In May of 2002 the Agency, Environment Canada and Health Canada commented on the draft report and the consultation process requesting further information in some areas and new analyses in others. The comments from these government agencies are documented in Chapter 5.

In July of 2002, in response to comments from the CNSC and other federal agencies, OPG began the preparation of this revision of the earlier draft EA Study Report and resumed the community consultation program. In August of 2002, OPG submitted a document consisting of the earlier draft EA Study Report and sections of the Detailed Decommissioning Plan for review by interested members of the community and local government representatives.

Guidance on the required scope of the EA, including scope of the project and scope of the assessment, was obtained over time through consultation with CNSC staff in accordance with sections 15 and 16 of the *Act*.

1.3.4 Compliance with Requirements of the Canadian Environmental Assessment Act

This EA Study Report has been prepared in accordance with the requirements of the *Act*, as shown in the compliance table in Appendix C.4.1. In addition, it has taken into account all comments and direction from the CNSC and other Federal Authorities, as indicated in Appendix C.2 and Appendix C.4.

1.4 Purpose and Organization of this EA Study Report

This EA Study Report responds to the needs for a Comprehensive Study as outlined in Section 1.3. The report is organized into 12 chapters plus references, acronyms and appendices as follows:

1. **Introduction:** describes the purpose of the project, the history of the site, the regulatory environment, the scope of the project and the scope of this assessment;

2. **Alternatives:** describes and evaluates from cost, timing and environmental points of view, alternative options for carrying out the decommissioning and different means of dealing with specific aspects of the decommissioning activities.

3. **Description of the Proposed Decommissioning Project:** describes how the project will be carried out and the key works and activities that are involved;

4. **Environmental Assessment Methodology:** describes how environmental effects will be determined and measured;

5. **Community and Stakeholder Consultation:** outlines the consultation program undertaken and notes the concerns of the public and other stakeholders;

6. **Description of the Existing Environment:** describes the existing environment (i.e. baseline conditions) in the area of the project and its most important features, including a description of Valued Ecosystem Components (VECs) and Valued Social Components (VSCs);

7. **Potential Project/Environment Interactions:** shows how the various works and activities involved in the project might interact with the environment and in particular with VECs and with any public concerns;

8. **Assessment of Likely Direct Effects and Mitigation:** focuses on the potential interactions (identified in Chapter 7), determines any residual effects, and indicates ways by which such effects might be mitigated;

9. **Assessment of Likely Cumulative Effects and Mitigation:** addresses the possibility of residual effects from the decommissioning project interacting with effects from existing and future projects;

10. **Monitoring and Follow-up Program:** describes the nature of the program, locations for monitoring and the duration and/or frequency of monitoring activities.

11. **Significance of Residual Adverse Effects:** assesses the significance or importance of adverse residual effects on the environment;

12. **Conclusions of the Assessment:** indicates whether there are any likely adverse environmental effects which cannot be mitigated and whether there are any outstanding public concerns.